FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 77 Thursday, November 22, 1945 No. 1527

What is Dirt?

A medical doctor in a recent address to the [American] Gray Iron Founders' Association had some illuminating remarks to make on the subject of dirt. Unfortunately, there exists in the mind of the layman the notion that the foulness of dirt varies directly with the colour. According to this doctor, a baker or miller is covered with a much fouler type of dirt than an ironmoulder, but nobody minds much! Actually, coal dust is quite a harmless type of dirt, whereas many other sorts are potentially dangerous. Once it is instilled into the minds of the apprentice moulder that coal dust is harmless and easily removable much of the prejudice against taking employment in foundries will be removed. It has often been stated that mothers strongly object to foundry dirt being taken into the homes. Maybe some do, yet we recently visited a modern foundry very largely staffed by mothers and failed to receive any confirmation. Excellent washing and changing accommodation for these women workers was provided, but the end of shift saw an unwashed army scrambling to board the first available homeward-bound omnibus. Hence we have lost faith in this argument.

Actually the very minimum of dirt is taken into the home on the body; it is the ridiculous habit of leaving the works without changing into house clothes which is at fault. A member of a London foundry education committee was so appreciative of this fact that he offered to supply—if the necessary coupons could be forthcoming—suitable overalls for all lads attending the daytime courses of the Borough Polytechnic. This offer is significant of the desire of those operating at the highest level of the industry to kill once and for all the inalienability of dirt from foundry practice.

It is desirable that our scientists should create a new classification of dirt not based on its colour, but on its general noxious character. A recent visit to a Continental city where coal—and therefore hot water—and soap are in very short supply, provided us with ample olfactory evidence of what "real," yet in this case, unavoidable, dirt can bring about. By noxious dirt we mean the types which induce skin diseases and promote germ propagation. It is difficult under present conditions for all foundries to provide the necessary facilities for washing and changing. However, as soon as normal conditions prevail, a real nation-wide effort should not only be made to instal these facilities, but, in addition, it should be made a condition of employment that each new entrant to the industry should guarantee to use them.

We have an inherent horror of slogans, but modern publicity seems to thrive on them. When we were young there was the slogan glorifying dirt. It ran: "Where there's muck, there's money." Later the medical pundits, with an equal lack of erudition, rephrased it to read: "Where's there's dirt, there's disease." Thus as a slogan for the future, we postulate the following: "Where there's dirt it must be eradicated at source." This is well in line with the modern conception of dirt, which is just material in the wrong place. The elimination of dust, the major trouble in the foundry industry, is not an impossibility. Yet it requires to be kept in a proper perspective, for we understand that the State of New York demanded from the foundry owners that their shops should be freer from dust than that normally existing in the average city street! The cleanest places we have ever seen are surgical operating theatres, yet to avoid contact with some sort of "dirt" the staff envelopes itself in protective clothing so as to resemble members of the Ku-Klux-Klan. Surely it is time to place the subject of dirt on a more intelligent basis.

C. A. PARSONS & COMPANY, LIMITED, of Newcastle-upon-Tyne, have removed their Bristol office to 15, Great George Street, Park Street, Bristol, 1.

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FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

NOVEMBER 23.

Institution of Mechanical Engineers :—"The Place of Women in Post-war Engineering," by Miss Verena Holmes. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

NOVEMBER 24.

Institute of Welding (Sheffield branch) :—Joint meeting with Doncaster Engineering Society. At the Technical College Hall, Doncaster, at 6.30 p.m.

Keighley Association of Engineers :—Visit to A. V. Roe & Company, Limited, Yeadon.

NOVEMBER 26.

Association of Bronze and Brass Founders :—Scottish area meeting. At the Grosvenor Restaurant, Glasgow, at 1 p.m.

NOVEMBER 27.

Iron and Steel Institute :—Joint meeting with the Lincolnshire Iron and Steel Institute. "Sinters and Sintering—Part 1," by Dr. H. L. Saunders and Dr. H. J. Tress. At the Technical School, Cole Street, Scunthorpe, at 7.30 p.m.

NOVEMBER 28.

Institute of Welding :—"Metallurgical Features of Welded Steel," by Dr. H. O'Neill. At the Institution of Civil Engineers, Gt. George Street, London, S.W.1, at 6 p.m.

NOVEMBER 29 and 30.

Institute of Vitreous Enamellers :—Annual meeting. (For details see our issue of October 18.)

NOVEMBER 30.

Institute of Welding (East Scotland branch) :—"Design of Building and M/C Structures," by M. Riley. At the Heriot Watt College, Chambers Street, Edinburgh, at 7.30 p.m.

Keighley Association of Engineers :—Members' discussion night. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Institution of Mechanical Engineers :—Discussion on "Pistons and Piston Rings," centring on short Papers introduced by J. S. Courtney-Pratt, G. J. Tudor, and Dr. B. Pugh. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

Manchester Association of Engineers :—"Metallic Materials Inspection, with Particular Reference to Non-destructive Testing Methods," by J. E. Garside. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

DECEMBER 4.

British Society for International Bibliography :—"Plastics: Their Nomenclature and Classification," by Dr. R. T. W. Reynolds and W. A. Silvester, and "The Information Bureau of the Electrical Research Association," by A. E. Tooke. At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, at 2.30 p.m.

Iron and Steel Institute :—Joint meeting with the Sheffield Metallurgical Association. "Mould and Core Paints and Washes, and Parting Powders," by Dr. W. J. Rees. At Sheffield Metallurgical Club, 198, West Street, Sheffield, 1, at 7 p.m.

DECEMBER 14.

Staffordshire Iron and Steel Institute :—Open discussion: "How Far Can Iron Castings Replace Steel?" At the Dudley and Staffordshire Technical College, The Broadway, Dudley, at 7 p.m.

Institute of British Foundrymen

NOVEMBER 24.

Bristol branch :—"Duplex Pump Castings," by Brown and Dewhurst. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

Falkirk section :—"Enamelling and Protection Finishes for Cast Iron," by W. W. Shaw. At the Temperance Café, Lint Riggs, Falkirk, at 6 p.m.

NOVEMBER 26.

Sheffield branch :—"The Technological Principles of Casting Design," by Prof. V. M. Shestopal, presented by W. H. Salmon. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

NOVEMBER 28.

Birmingham branch :—Short Papers on "Economical Quick Methods of Preparing Plate Patterns for Limited Quantity Production." At the James Watt Institute, Great Charles Street, Birmingham, at 7.30 p.m.

London branch :—"The Technological Principles of Casting Design," by Prof. V. M. Shestopal, presented by C. H. Kain. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

MYSTERIOUS CAUSE OF WASTERS

By "CORONER"

Whilst most wasters are due to some obvious cause, a few occasionally give an investigator a considerable amount of thought before the true solution is arrived at. One such case concerned a number of medium-sized plate-centred wheels with light rims, made in halves on a jolt machine, and in circular boxes. A considerable number of these wheels were successfully produced, with occasional periods of trouble with what at first was considered to be "offset."

On each occasion when this was reported, a check-up was made on the pattern equipment and moulding boxes, to ensure that no movement had taken place. Each time the pattern and boxes were in order and the reason for the defect was not apparent. It was then decided to segregate any that were defective in future and ascertain if the "offset" was always in the same direction and of the same magnitude.

After a further number had been scrapped and put on one side, they were examined and it was found that the defect was not an "offset" in the true sense of the term, for the point diametrically opposite the defect matched perfectly. Measurements were then taken which revealed that one-half of the wheel was undersize by the amount of the supposed "offset." A check was next made on the moulds, which were of dry sand, to determine if any movement of the sand had taken place during drying. One or two did show signs of the outer rim of sand being somewhat distorted in such a manner as would cause the defect under consideration.

How did this distortion take place and how was it only on certain moulds? A careful check of all the operations prior to and after stoving revealed that each mould, as it came off the machine and was dressed, was correct for size, but when dry a number were still as before. These, it was found, were the ones in the bottom of the stacks of moulds which were carried to the stoves in a travelling crane, and a closer examination revealed that the pieces of metal used to keep the boxes apart during drying were not always placed wholly on the metal rims of the box, but occasionally across the sand, and consequently the weight of the other boxes pressed the mould inwards at this point.

Subsequent moulds were loaded on specially prepared distance pieces, and the trouble disappeared. This is an interesting example of the need to watch each operation—even the simplest—before a satisfactory solution to an otherwise mysterious occurrence can be found.

THE GATING AND FEEDING OF STEEL CASTINGS*

Higher yield of sound castings results from application of science to gating problems

By S. T. JAZWINSKI, Dpl.-Ing. Met. (Member), E. D. WELLS, Assoc.Met. (Member) and S. L. FINCH (Member)

(*Continued from page* 228.)

Bottom Gating and Top Feeding

In Fig. 14 the isotherms caused by this system are shown. It can be seen that the hottest metal is in the casting surrounded by the hottest sand, due to the flow of metal from the gate, and the coldest metal is in the head surrounded by cold sand and the atmosphere. Naturally, heat conducts away much more quickly from the feeder head, and unless this is counteracted by mass effect of the head, the centre portion of the casting will still be liquid when the head has solidified. This system of gating, although often used, is against all theoretical laws of feeding, and does not lead to economical production of sound castings.

Top Gating and Top Feeding

In Fig. 15 the isotherms existing in this system are shown. It can be seen that the hottest metal is in the head surrounded by fairly hot sand and the atmosphere, whilst the cooler metal is in the casting, again surrounded by reasonably warm sand. This system of gating is theoretically correct, but is rarely a practical proposition.

Step Gating and Top Feeding

This system, shown in Fig. 16, shows that the coldest metal is in the region farthest away from the head, whilst the hottest metal is located in the feeder head. Both the casting and the head are surrounded by sand at approximately the same temperature, and it would appear that in most circumstances these conditions are favourable for directional solidification.

Gating Through a Whirlhead

This system, shown in Fig. 17, shows that all conditions are in favour of directional solidification. Due to the hot metal passing through the head, the surrounding sand becomes incandescent. The hottest metal is thus located in the head and is surrounded by hot sand. The cooler metal is in the casting and is surrounded by relatively cold sand.

From these brief descriptions, it is obvious that gating through a whirlgate head, top gating, and step gating are the methods for the production of directional solidification. Of these, top gating is unsatisfactory for the obvious reason of high drop of liquid

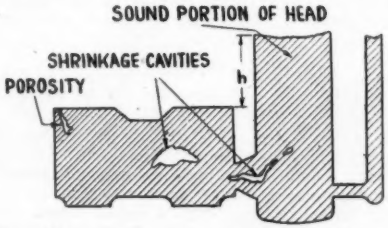


FIG. 20.—CASTING SHOWING DEFECT DUE TO PUNCTURED SKIN.

steel, and step gating is not nearly so convenient to adapt as gating through a whirlgate. Instances of castings gated to promote directional solidification are shown in Figs. 18 and 19. Gating with these points in mind can result in an increased yield with the production of sound castings.

IV—The Speed of Metal Supply to the Actual Casting

The speed of metal supply to a casting is dependent on four variables:—(*a*) Velocity of metal entering the runner bush; (*b*) cross-sectional area of downgate and ingate; (*c*) shape of ingate or downgate; and (*d*) height of metal in the mould to the runner bush.

(*a*) *Velocity of Metal Entering Runner Bush.*—The speed the metal enters the runner from the runner basin or cup will cause variation in running speeds. This speed varies and depends on the type of ladle (bottom or lip poured) and size of nozzle used, the amount of steel in the ladle, and the arresting effect of the type of runner bush. It is assumed that the distance between the bottom of the ladle and the runner bush are for practical purposes constant.

(*b*) *Cross-sectional Area.*—The amount of metal that enters the mould is directly proportional to the sectional area of the *smallest* part of the ingate or downgate. For instance, if a mould of 2,000 ml. of metal is filled in 10 secs. by an ingate whose smallest sectional area is 4 sq. cm., the same mould could be

* A Paper read at the 42nd annual meeting of the Institute of British Foundrymen, held in London, June 15 and 16, 1945. The Authors are respectively chief metallurgist, foundry superintendent and foundry methods engineer, K. & L. Steelfounders & Engineers, Limited, Letchworth.

The Gating and Feeding of Steel Castings

filled in 5 secs. by an ingate having a minimum sectional area of 8 sq. cm. The time for filling a given mould is inversely proportional to the sectional area of the ingate.

(*c*) *Shape of Ingate and Downgate.*—The third factor governing the speed of metal entry into the mould is the form of ingate and downgate. Wherever there is a step or arrest point in the gating system, a certain amount of velocity will be lost. This is deliberately used in many cases to reduce the velocity of metal entering the mould.

(*d*) *Height of Metal.*—The velocity of the metal passing through the smallest section in the ingate is proportional to the head of metal in the runner, that is, the distance between the metal in the mould and the pouring basin. Not taking friction of downgate walls into consideration, the speed of metal going into a mould is given by:—

$$V^2 = 2gh.$$

Many defects in castings are caused by incorrect gating, the chief defect being shrinkage.

Cause.—This defect is dealt with under the feeding of casting, but, nevertheless, correct gating can overcome many difficulties. Shrinkage may be caused by: (1) Running into a heavy section which is a considerable distance away from a feeder head; (2) the early freezing of an ingate may cause small shrinkage cavities at the junction of the casting and ingate; (3) wrong disposition of runner or runners so that they do not promote directional solidification; and (4) creation of hot spots.

Remedy.—(1) In any casting, it is the ideal to obtain the coldest metal at the farthest point away from the head, whilst the hottest metal is adjacent to the feeder. At the same time, where thin and thick sections occur in a casting, it is advisable to have the hottest metal in the thin section with the colder metal in the heaviest parts. When gating, these facts should be borne in mind, so that a casting free from shrinkage caused by incorrect gating can be obtained.

(2) If the ingate freezes quickly, and before the section of the casting it runs into, a small cavity may appear on the face of the casting. It is advisable to gate a casting at one of its thinnest sections so that this defect may be avoided wherever possible, unless the whirlgate head is used.

(3) When gating a casting, it is essential to have directional solidification to ensure a casting completely free from shrinkage cavities. The use of chills should, of course, be encouraged in this respect, but a casting should always be gated with the object of securing directional solidification (see Fig. 19).

(4) The repeated supply of hot metal over a sand face heats this sand up to a temperature of the incoming steel and becomes a good insulation against radiation. A careful watch should be kept in the region of the ingate entry for the occurrence of hot spots and the necessary precautions taken.

General Description of Gating and Feeding

There are four different systems of gating and feeding applied to castings. All these are well known and

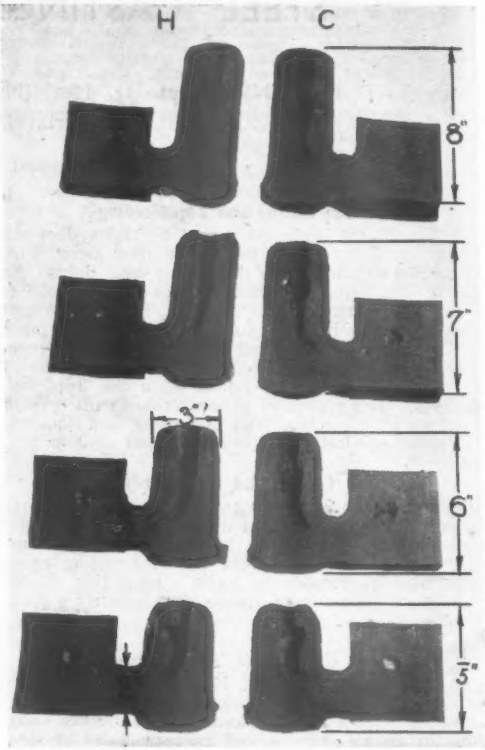


FIG. 21.—EXPERIMENT SHOWING THAT INSUFFICIENT HEAD HAS BEEN PROVIDED TO YIELD A SOUND CASTING.

are used in everyday foundry practice. It is only intended to outline these methods. The systems are:—(*a*) Orthodox; (*b*) whirlgate; (*c*) atmospheric whirlgate head; and (*d*) centrifugal.

(*a*) *Orthodox.*—This section can be split up into several sub-sections, such as:—(1) Bottom gating and top feeding (Fig. 14); (2) top gating and top feeding (Fig. 15); and (3) step gating and top feeding (Fig. 16). All these have been described in the "Physics of Feeding" outlining the promotion of directional solidification.

(*b*) *Whirlgate.*—Many founders have experienced the advantages of this type of feeding, but at the same

time many have obtained indifferent results. Gray, in his Paper, "The Side Feeding of Steel Castings," gives an explanation which accounts for the occasional failure of the whirlgate. In Fig. 20, a casting is shown which has developed a source of porosity in the skin, thus puncturing the solidified crystals and exposing the

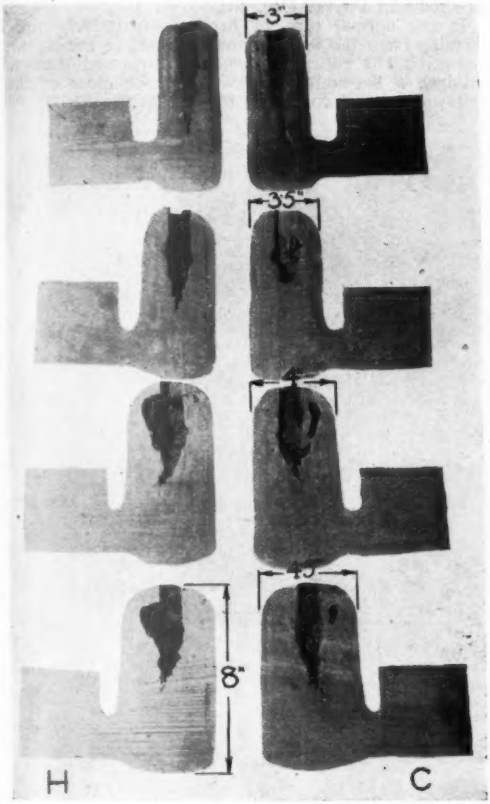


FIG. 22.—SHOWING A MINIMUM DIAMETER OF 3½ IN. WILL YIELD A SOUND CASTING.

liquid interior of the casting to atmospheric pressure. If, at this stage, the surface skin of the whirlgate head solidifies, the atmospheric pressure will make the casting feed the head. If the casting and the whirlgate head are sectioned, it will be found that the head is relatively sound, whilst the casting contains large shrinkage cavities.

Partially to offset this happening, the head should be kept open to atmospheric pressure by means of a pencil core. Before the skin of the casting is punctured, the effective pressure will be (see Fig. 20) h (ferrostatic) plus atmospheric pressure. Immediately the casting skin is punctured, the atmospheric pressure is neutralised, and the effective pressure is now only h (ferrostatic). Whilst this may be insufficient to pro-

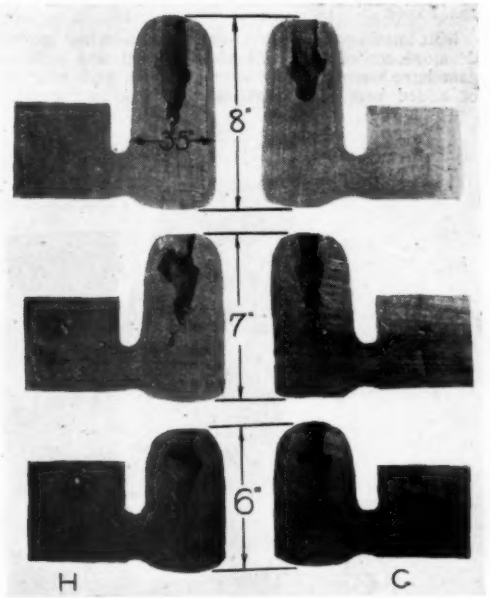


FIG. 23.—SHOWING THAT WITH 3½-IN. DIA. A HEIGHT OF 8 IN. MUST BE MAINTAINED.

duce a casting free from shrinkage, it will prevent the casting feeding the head, and consequently the shrinkage cavities will not be as large as formerly, and will probably be located at the junction of the head and the casting.

Whilst this arrangement is not satisfactory, it may prevent a casting being scrapped completely by reducing the shrinkage to a degree which may be rectified by welding. The puncturing of the casting skin occurs occasionally, but if the whirlgate head is kept open, a balanced system is maintained. Moreover, if the rupture of the casting skin is finally sealed off, the atmospheric pressure becomes once more effective in the head. If the head was not open, only gravity of the head metal would become effective, and due to the viscous nature of the solidifying steel, this pressure would be insufficient to give a casting free from shrinkage.

The Gating and Feeding of Steel Castings

(*c*) *The Atmospheric Whirlgate Head.*—This modification of the more orthodox type of whirlgate head was the result of a scientific study of the function of a feeder head. This has been described both from the theoretical and practical aspect in different sections of the Paper.

(*d*) *Centrifugal.*—Recent years have seen the gradual development of this method of casting and sufficient data have been given in recent Papers, and little can be added here to that already published.

The Supply of Liquid Steel from a Feeder Head

The efficiency of a feeder head can be studied by sectioning and examining the freezing formation and the disposition of the shrinkage cavity. Reference has been made to the different forms of shrinkage cavities formed in various heads. The ideal shrinkage cavity obtained in a head would be perfectly flat bottomed, as shown in Fig. 29 (No. 14).

In the normal type of head, comparatively quick freezing from the walls of the head causes the shrinkage cavity to be carrot-shaped. Obviously, then, to produce a flat-bottomed cavity, one or more of the following sets of conditions must be achieved.

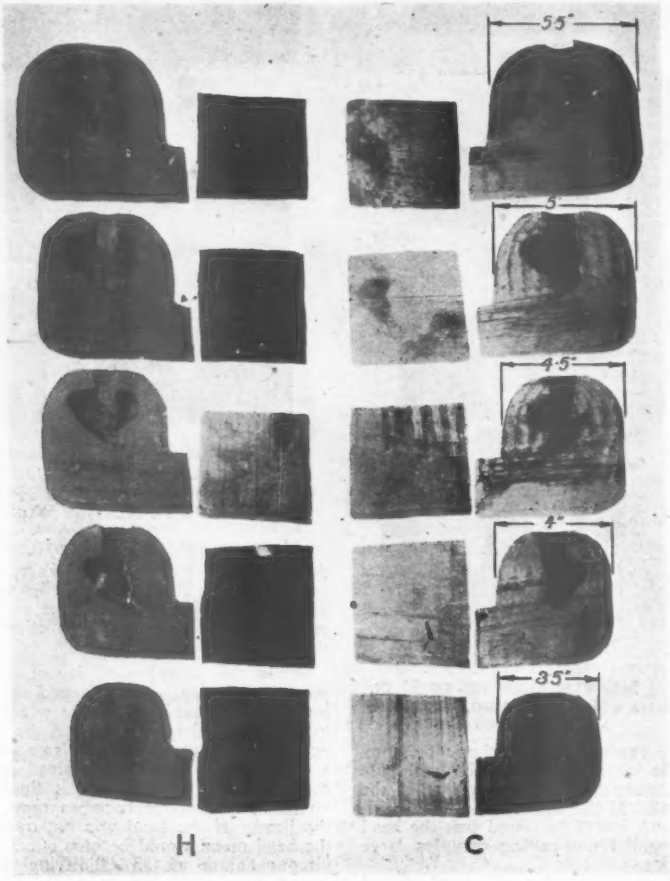


FIG. 24.—THE MINIMUM HEAD TO GIVE A SOUND CASTING IS SHOWN TO BE 4.5 IN. DIA.

(1) A very steep temperature gradient between head metal and casting so that *all* the head is liquid after the casting has solidified. Under present conditions this is not practicable.

(2) Increase of fluidity of the head metal either by (*a*) increasing the temperature, or (*b*) increasing the carbon content. (*a*) can be accomplished using feeder powder, and (*b*) by the use of feeder powder or graphite rods.

(3) Heat radiation and conduction must be prevented on all sides. At the present time this can only be reduced to a minimum by enclosing the head on all possible surfaces in dry sand.

The Solidification of an Open-type Gravity or Whirlgate Head

When the mould has been completely filled, a thin envelope of crystals forms very quickly on the surface of the head due to rapid radiation of heat from the head surface to the atmosphere. This immediately excludes the effect of atmospheric pressure and the head must rely on gravity feed only. Crystallisation begins at the contact face of metal and mould, and speed of crystal growth is governed by metal temperatures, and the radiation and conducting properties of the sand face. The final cavity formed depends on the rate of feed demand of the casting.

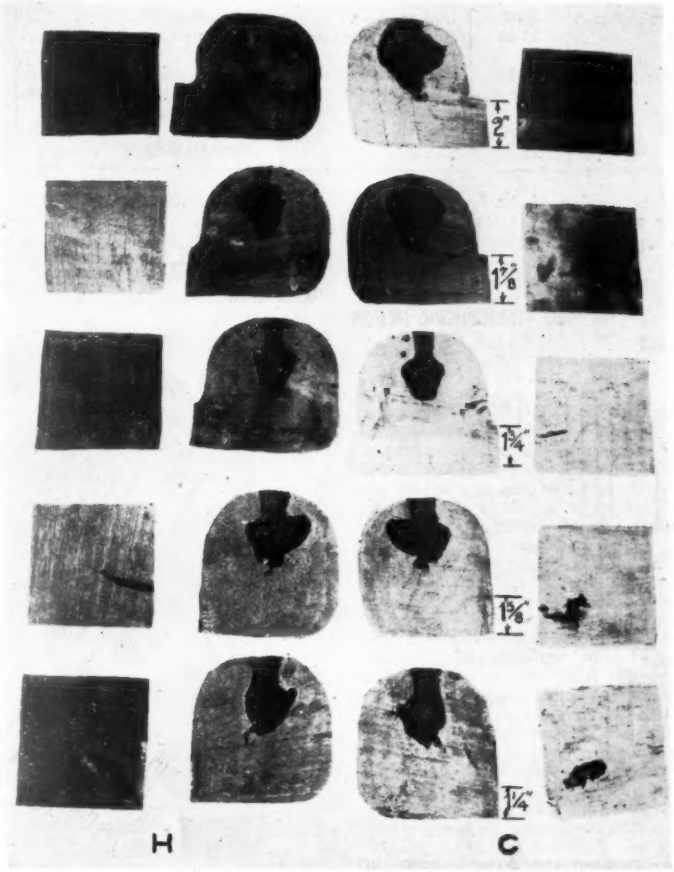


FIG. 25.—THE MINIMUM NECK DEPTH IS SHOWN TO BE 1¼ IN. TO GIVE A SOUND CASTING.

The Gating and Feeding of Steel Castings

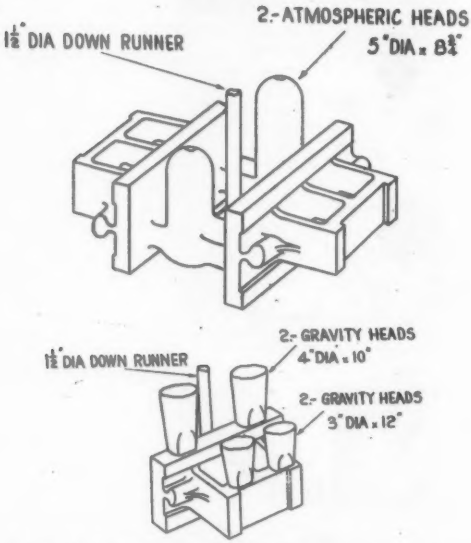
The Solidification of a Blind Whirlgate Head

Immediately the mould is filled, a thin envelope of crystals form, as shown in Fig. 17. Round the pencil core, liquid steel quickly heats this thin core to an incandescent temperature, and therefore no steel skin forms round the lower portion of the core, this allowing the atmospheric pressure to penetrate through the pores of the sand and exert its influence on the still liquid interior.

Crystal formation begins to take place at the sides of the head and is proportional to the rate of radiation of heat from the surface of the head. This top part of the head solidifies the quickest, but as liquid steel is demanded to compensate for shrinkage inside the casting, no further crystallisation can take place because no liquid steel is in contact with the ingrowing crystals.

TABLE I.—*Factors to be Associated with Various Systems of Gating and Feeding.*

No.	Gating and Feeding Method.	Yield, Per Cent.	Feeding Efficiency.	Type of Castings.	Supervision Necessary.
1.	Gravity (orthodox) ..	40-60	Lowest	Any castings	Least.
2.	Whirlgate	55-65	More efficient than (1)	Casting up to approx. 1 ton ..	Between 1 and 3.
3.	Atmospheric.. ..	60-75	Much better than (1) and (2)	Properly designed castings up to 10 tons can be made with this method	Between 2 and 4.
4.	Centrifugal	65-85	Most efficient ..	Circular or symetrically designed castings	Highest.



FIGS. 26 AND 27.—SHOWING THE ATMOSPHERIC AND GRAVITY USED IN THE EXPERIMENTS DETAILED IN TABLE III (*see* next instalment).

The final cavity depends on the rate of radiation of heat from the walls. That is, if there is a fast dissipation of heat from the freezing walls, crystallisation will be fast, and consequently the cavity formed will tend to be more carrot shaped than if freezing had been slower.

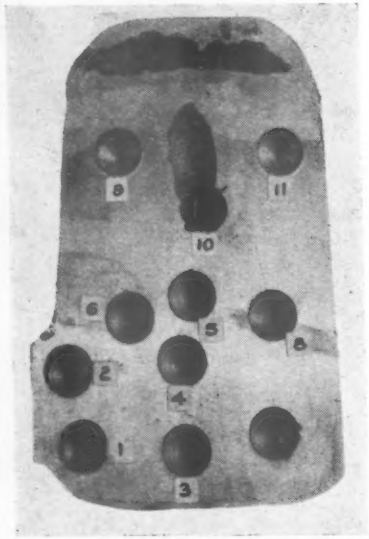
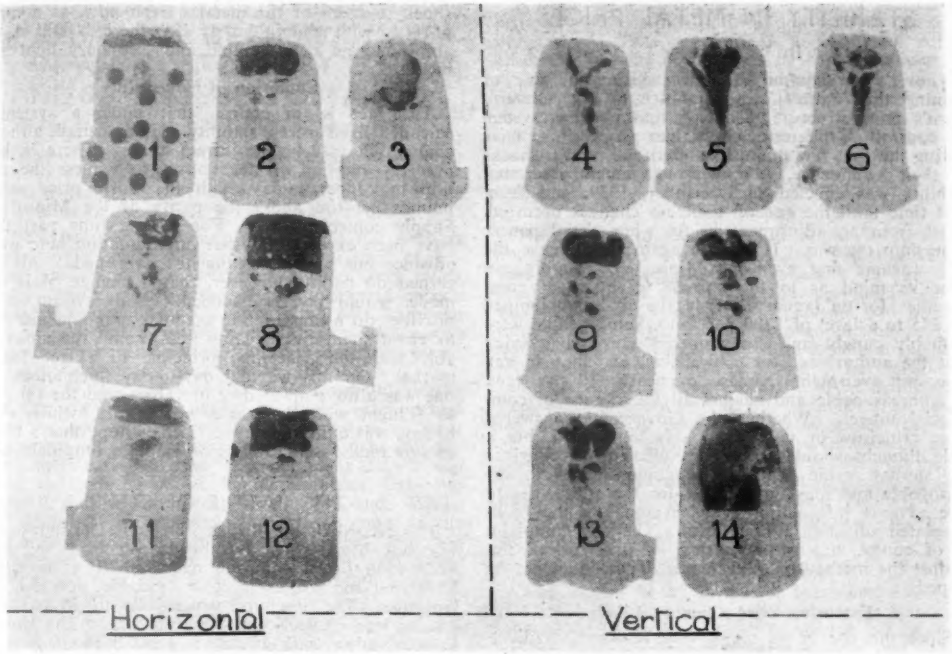


FIG. 28.—POSITIONS OF TESTS TAKEN FOR ASCERTAINING CARBON SEGREGATION.



FIGS. 29 AND 30.—SHOW SECTIONED HEADS DETAILED IN TABLE IV (*see* next instalment).

An efficient feeder head should freeze slowly, and, indeed, much slower than the casting, so that (*a*) there is a continual supply of liquid metal to the casting, and (*b*) so that the shrinkage cavity will have a tendency to be flat bottomed. This slow freezing permits the use of a smaller head, and if the head could be kept liquid whilst the casting solidifies, very little head metal would be necessary.

From these points it is clear that, if the rate of solidification of a head can be reduced to a minimum, the head size can also be reduced to its minimum size under the prevailing conditions. Obviously, then, an efficient feeder head should have a very low rate of solidification, and one thing that controls the rate of solidification is the sand forming the shape of the head. This sand (or any alternative material) should be preheated as much as possible before being filled, so that it should act as an insulation conserving as much heat as possible in the feeder head.

It may be possible still further to conserve heat in a feeder head by (*a*) substituting an insulating material for the sand forming the head shape; (*b*) keeping the head liquid by means such as a small electric arc or heated coils; (*c*) lowering the freezing point of the liquid steel; or (*d*) exothermic reactions. At the present time (*a*) and (*b*) are possible, but on a commercial

(*Continued overleaf, col.* 2.)

STABILITY IN METAL PRICES

By "Onlooker"

Those who acquired the habit during the war of pinning their faith to the stability of the Government's price structure, believing that under a system of control no alteration in values is possible, have during the past few months suffered one of two shocks to their confidence. It will be remembered that stability was effected in December, 1939, and from that time until the end of 1943, no changes occurred, apart from an adjustment in tin when the Japanese came into the war. It was tin again which gave the first warning that even the Ministry of Supply can alter its mind as to the correct valuation of commodities, for on January 1, 1944, the quotation jumped by £25 to a level of £300 per ton. Some people were probably caught and complained accordingly, saying that the authorities gave no warning, and that, in any case, an over-night increase of nearly 10 per cent. was unreasonable and against all the canons of commercial usage. Whether the Government answered these criticisms or not is probably immaterial, but a little thought should surely be sufficient to convince the sternest critic that in the circumstances it was impossible and most inadvisable for the authorities to give advance information of when and how they contemplated adjusting a price level. The real complaint is, of course, against the system of fixed prices, not against the method of adjustment. That could not be helped.

Extensive Price Changes Likely

Since the rise in tin there have been other adjustments, and the past 12 months have made it quite obvious to the most hidebound disciple of the cult of stability that there is, in fact, no such thing as a fixed price in perpetuity. And when the changes do come they are likely to be on a somewhat shattering scale. Consider the recent change in the price of quicksilver from its wartime level of £68 10s. per flask to £30. Silver, on the other hand, jumped up from 25½ pence to 44 pence, but it must be confessed that the trade had a pretty good idea that something was going to happen because of events in the United States. This year we have seen an unexpected adjustment in lead and zinc, the former moving by £5 and the latter by £5 10s., but representing an appreciation of about 20 per cent. No mean advance! If it is argued that no surprise should have been felt on this account, since the United Kingdom parity was below the world value, it must be pointed out that both copper and tin are in this position, and that, moreover, even with the change, lead and zinc still remain below the world level; quite considerably under it, in fact. The stability of aluminium at £110 has been broken by a cut of £25, but here, again, the decision to make a change was underlined by the fact that secondary light alloy metal was on offer at a price which assured to the buyer an altogether exceptional margin below the virgin ingot. Moreover, unlike copper, lead and zinc, there was no open market in aluminium futures, so that price changes, when they came, savoured somewhat of a shock to users of the metal. Even now, as a matter of fact, with aluminium at £85, there is still a very ample margin between that and secondary light alloy metal.

Condition of Uncertainty

The fact is, of course, that under a system of so-called fixed prices, stability is not assured, although changes in value come infrequently. There is, however, a condition of uncertainty, as witness the position in copper to-day, with the world price several pounds per ton above the parity of the Ministry of Supply control figure. For a long time past there have been expectations that our quotation here would advance but so far nothing has happened. All concerned do realise, however, that a change, if it were made, would be very sudden. This system, which provides no means for the manufacturer and merchant to cover themselves against loss, compares unfavourably with the peacetime principle of a free futures market. On this we had day-to-day fluctuations, but one was always up to date in values, and the time-lag, so fraught with dangerous possibilities, which exists to-day, was quite unknown. Let us hope that a return to *safe* methods of trading will not be long delayed.

THE BATTLE OF STEEL

This record of the British iron and steel industry at war has been issued by the British Iron and Steel Federation for distribution overseas. It is profusely illustrated and written in clear, readable, non-technical language. The brochure, which runs to 56 pages, is divided into six sections. The fifth one, "The Human Factor," might with advantage have been the first, as it covers the first and extraordinarily difficult task imposed upon the industry—that of blacking-out the light emanating from thousands of furnaces, coke ovens and the like.

To the reviewer, the section dealing with the struggle for raw materials is most interesting, as it reveals that there is romance and adventure in the servicing of industry comparable with the schoolboy yarns of the Spanish Main. It is to be deplored that the brochure is not generally available in this country.

British Brown-Boveri, Limited, have removed from 22, Worple Road, London, S.W.19, to Artillery Mansions, 75, Victoria Street, S.W.1.

THE GATING AND FEEDING OF STEEL CASTINGS

(*Continued from previous page.*)

basis would be very difficult to apply. It is felt, however, that future research may lead to developments along this line of thought; (*c*) is described in the experimental part of the Paper dealing with graphite rods. The advantages and disadvantages of the gating and feeding methods are summarised in Table I.

(*To be continued.*)

A NEW METHOD OF INVESTIGATING THE BEHAVIOUR OF CHARGE MATERIAL IN AN IRONFOUNDRY CUPOLA, AND SOME RESULTS OBTAINED

By N. E. RAMBUSH and G. B. TAYLOR

Discussion on a Paper read at the annual meeting of the Institute of British Foundrymen, the senior vice-president (Mr. D. H. Wood) presiding. The Paper was printed in our issues of November 8 and 15.

The CHAIRMAN, expressing gratitude to the Authors for having given so early the benefit of their experience, said that obviously they had given very much thought to the carrying out of their tests and experiments. Commenting on a remark by Mr. Rambush that he was not a member, the chairman suggested that his direct association with the Institute would be of considerable benefit to the Institute.

MR. L. W. BOLTON, A.M.I.Mech.E., congratulated the Authors on the originality of their experimental methods, and said the results obtained were of great interest to all who studied the cupola. The conclusions submitted had been very cautiously drawn, and from an examination of the experimental data put forward, they appeared to be generally sound. Whilst the Authors had provided answers to some of the matters on which information was required, they had brought forward numerous new questions, and it was pleasing to note that further research into some of these was continuing.

Cause of Lining Wear

In the Paper several most interesting facts were noted almost without comment. For example, an interesting point with regard to the lining of the cupola used for the experiments was that a layer of insulating bricks was provided between the shell and the refractory lining. Experience of lining erosion in cupolas seemed to show that, other things being equal, the rate of erosion with a thin lining was less than with a thick one. The explanation was that the heat loss by radiation and convection from a thin lining cooled the refractory and thus increased its life. Many members would support the view that the last inch of lining before the shell would last longer than an inch on the inside. The use of an outer layer of insulating bricks, therefore, would be expected to result in an increased temperature in the refractory lining, with a consequent increase in the depth of erosion during a melt.

The data showed that the cupola was operated on a melt of 4½ hrs., and the diameter of the lining increased at the maximum by 10 in. That was equivalent to an average erosion from the lining of rather more than 1 in. per hr., which was definitely high, though not unduly excessive if a large part of the metal melted contained high proportions of steel scrap. He asked, however, whether the Authors considered that the use of insulating bricks gave an improvement in metal temperature and whether that aspect of lining wear had received consideration.

It was unfortunate that the experiments had not provided any definite information on the cause of lining wear. That question was of very great importance and, in spite of the facts he had mentioned, the evidence at present available did not support the view that erosion in the melting zone was due entirely to the effect of temperature. Cupola linings of basic material having a refractoriness 200 deg. C. higher than that of normal acid materials, showed no improved resistance, and the rate of erosion was very similar.

Slag Ledges

With regard to the formation of the "slag ledge" above the tuyeres, Mr. Bolton agreed with the Authors that it must have had some influence on conditions in the cupola at the end of the melt when the test was in progress. All cupola operators had at some time or other experienced that phenomenon, and certain conditions of operation were known to be more prone to produce it than others. Excessive blast velocities at the tuyeres, especially when melting high steel charges, could lead to that trouble. The operating data supplied gave no real clue to the formation of the bridge, although the blast pressure used at periods of the melt was rather high for the melting of a mixture containing 60 per cent. steel. Whilst it might be difficult to trace the cause of the bridge, he did not consider that its formation should be regarded as inevitable.

Metal Slag Interface

With regard to the suggestion that part of the coke bed below the tuyeres was lifted by the molten metal as it collected in the well, he personally believed it to be true. Some evidence had been obtained that on large cupolas the whole coke bed would tend to rise and fall as the well was filled and emptied. From the illustration in Fig. 2, it appeared that the Authors had found no coke at all in that portion of the well containing the metal and slag, and he asked for confirmation of that. Checks on the holding capacity of the wells of various cupolas did not suggest that much coke-free space became available.

A factor which would tend to reduce the size of the coke in the well, and which was not mentioned in the Paper, was that low-carbon metal would undoubtedly continue to pick up carbon after passing the tuyeres. During a 4½-hr. melt, when steel mixtures were being used, carbon absorption could take place to an extent sufficient to account for that reduction in the size of the pieces of coke in the well. Proof of that could be obtained if a similar experiment were carried out on a cupola melting eutectic or hypereutectic mixtures.

Carbon Pick-up

In connection with the findings relating to carbon pick-up, only passing reference was made in the Paper to the influence of other metallic constituents of the charges, but he believed that their influence was important, and that in any investigation into the mechanism of carbon pick-up their influence should have been examined. The cast-iron portion of the

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charge melted at a higher level than the steel, and in a mixture containing only 10 per cent. of the latter the pieces of steel would be subjected to a continuous bombardment by drops of molten cast iron. Samples of partly-melted steel taken from cupolas, which he had examined under the microscope, had shown that, where carburisation was deepest, traces of phosphide eutectic were present on the surface, which confirmed that the carbon was derived from contact with cast iron. Carbon picked up by the surface of the steel in that way would, at the temperature obtaining, diffuse into the metal fairly rapidly.

The fact that charges of 100 per cent. steel were more difficult to handle satisfactorily in the cupola than, say, 50/50 mixtures of steel and cast iron suggested that carburisation in the manner outlined played an important part. Deposition of cast iron on the steel scrap might account for the traces of graphitic carbon found in the scrapings from the test-bars, although he would not expect cooling conditions to favour the precipitation of graphite. A more likely explanation of that was that the scrapings contained traces of coke which had not been completely removed when the test-pieces were cleaned.

Sulphur Pick-up

The information put forward on sulphur pick-up was valuable and showed the reason why light scrap with a large surface area gave higher-sulphur metal than heavy scrap. It also confirmed that the gas flow near the walls of a cupola was greater than that near the centre. The Authors' finding that the sulphur content of the surface layers diminished when the steel scrap travelled through the bed was interesting. It was possible, of course, that in that zone, due to a change in the composition of the gas atmosphere, sulphur was driven off from the metal; but he asked if the Authors had completely discounted the possibility that in that zone the sulphur-rich metal had started to melt away.

MR. HALL, who asked if the Authors had quenched the cupola after a continuous run, said they had mentioned the possibility of other people using their very novel method. He imagined that it could be used quite successfully and safely, provided there was an adequate slag lining on the lining itself, but that one would experience quite an amount of trouble with the refractory if it were done on an almost new lining.

MR. J. L. FRANCIS, A.M.I.Mech.E., said the method used by the Authors was daring in conception and boldly carried out. In most ironfoundries, to have the cupola set solid when fully charged was regarded as a major calamity and, therefore, to be avoided; but the Authors had caused that to happen deliberately and repeatedly as a means of acquiring valuable information. No more direct means of tackling the problem could be devised. In view of the composition of the charges, the proportion of coke and limestone seemed rather high. However, that was incidental.

Precise Causes and Interpretation

Most of the results obtained were records of actual happenings, and could not be questioned. On the other hand, the precise causes and interpretation were not so clearly defined and they still remained to some extent subject to opinion and theory. For example, the Authors had established without question that the steel arrived in the melting zone with its original composition unchanged, except for a carburised skin and a slight increase of sulphur in the surface layer. The steel test-pieces were new, but if they had been rusty and oxidised, it was possible that there would have been even less pick-up by the time the melting zone was reached. Here the point arose as to the possibility of the drops on the outside of the steel being of cast iron or contaminated by cast iron; but he was proceeding on the assumption that they represented just the steel skin carburising and melting.

The interesting point about the carbon pick-up was that it was present in both the combined and the free form. Considering the temperature involved, the amount of carbon present and the quenching treatment, the presence of free carbon in the steel was very surprising. Bearing in mind that it was a skin effect only that was under consideration and that the introduction of water to materials at high temperature in the melting zone would cause a vigorous disturbance, was it not possible that the skin of the steel bars was in a state of incipient fusion and had picked up carbon in the form of coke dust, *i.e.*, mechanically mixed with the skin which had started to melt? Although the Authors had stated definitely that some of the carbon picked up by the steel remained graphitic in nature, they had not brought forward evidence to support that statement. If graphite were indeed present to the extent of about 50 per cent. of the total carbon pick-up, one would have imagined that some indication of it would have appeared in the photomicrographs.

Another interesting point which emerged was that steel of carbon contents as mentioned in the Paper melted at the following temperatures:—1.2 per cent. carbon steel began to melt at 1,420 deg. C.; 0.85 per cent. carbon steel began to melt at 1,450 deg. C.; and 0.5 per cent. carbon steel began to melt at 1,490 deg. C. Steel test-piece No. 7 was placed at the outside of the charge and was the highest up the stack to show any signs of melting. The skin of that bar had shown a carbon content of 0.56 per cent. At 5 ft. 6 in. above the tuyeres a temperature of about 1,490 deg. C. must have existed, therefore assuming that it was the carburised skin that was melting. Thus, the temperature of the melting zone was more than sufficient to melt even pure iron, and it was established beyond doubt that, even if no carbon were absorbed by the steel in the descent, it would still become liquid if its passage through the zone of maximum temperature were not too rapid, which under normal conditions was not likely to happen.

MR. T. HENRY TURNER, M.Sc., inviting the Authors to amplify their description of what happened when they applied water, asked whether there was a roaring sound, or just a sizzle which changed in tone as

the procedure continued. Commenting that no magnifications were stated for the photo-micrographs at the end of the Paper, he asked at what magnifications they were produced.

Charge Separation

MR. W. J. DRISCOLL, B.Sc.(Eng.), said if he interpreted correctly Fig. 2, which gave a graphic representation of conditions during a blow, it would appear that by the time the charges approached the level of the melting zone, all semblance of the original layer formation was entirely lost. If that were so, there seemed to be no theoretical reason why any lower limit should be set for the weight of the charge to be used in a given size of furnace; indeed, the efficiency should not be altered if the coke and iron were actually mixed before they were put into the furnace.

It appeared also from Fig. 2 that the materials in the centre of the cupola tended to descend rather more quickly than the materials at the sides, *i.e.*, the iron charge, which originally was level, seemed gradually to take the form of an inverted cone. If that were so, it was rather fortunate from the point of view of charge separation, for it was well known that the zone of highest temperature was also in the form of an inverted cone. In a further reference to Fig. 2, he said that in the centre of the cupola at tuyere level there was a zone containing coke which appeared appreciably larger than that surrounding it on all sides. He asked if the Authors could explain how the coke arrived in that position.

Inasmuch as a CO_2 recorder was used in conjunction with the cupola under consideration, he asked whether the Authors had found that instrument to be of any value from a control point of view. In Table I the CO_2 figure of 18 per cent. when the furnace was cold was perhaps understandable; but he asked whether the increase from about 9 per cent. in the morning to 12 per cent. in the afternoon was due to a higher coke percentage being used during the morning.

Coke Burning

The conclusion that the burning of coke occurred mainly at the outside of the lumps confirmed recent work by Brewin and Mott, who had carried out actual permeability tests on coke. They had found that, although coke was porous, it was relatively impermeable, *i.e.*, the pores were mainly unconnected, and that at low pressures combustion would therefore take place mainly on the surfaces of the lumps.

While the cold-charged furnace was available, did the Authors measure the blast pressure with the normal air volume passing through? He asked the question because it was generally believed that the main part of the blast pressure in the wind belt was due to the back pressure created by the expansion of the air and gases inside the furnace through heat. On that theory the blast pressure in the cold cupola should be lower, and he asked if the Authors could confirm that.

MR. G. L. HARBACH said that in one part of the Paper the selected cupola was referred to as being of 42 in.; perhaps that was a misprint, because in another part of the Paper it was referred to as a 48-in. cupola.

MR. RAMBUSH said it was 42 in. in the melting zone.

MR. HARBACH said that his main concern was the way in which the steel melted in the cupola. In the Paper it was stated: " Fig. 13 indicates the way in which the melting of the steel takes place. Test-piece No. 7 (outer zone), being the bar highest up the stack to be affected, shows that fusion has commenced on the surface, where drops or blobs of liquid metal can be seen." He felt that the blobs were actually of cast iron, which had come down just melted and had solidified on the steel. His view was that steel melted in the cupola, without necessarily carburising or with very little carburisation, prior to reaching the melting zone. The carburising of steel was a very sluggish action, requiring about 8 hrs. at 950 deg. C. to get ¼-in. of carbon; and then it was only 1 per cent. That was not much towards getting a steel plate melted. The speed with which the cupola charge dropped in the furnace was such that it had not time to absorb much carbon. He believed that some carburisation was due to small drops of cast iron melting above the steel and dropping on the steel plate. The Authors had suggested that the carburised surface melted and that it then trickled down; he suggested that it trickled down because it came to a point where the mixture of cast iron and steel was capable of melting. In Fig. 13, Specimen No. 7 showed the little blobs, and Specimen No. 5 indicated rivulets, which latter he regarded as caused by the mixture of cast iron and steel which had really started as blobs of cast iron. That view was supported by Fig. 14. The Authors had mentioned that they had analysed the blob in Fig. 14 and had encountered some difficulty; and in that regard he sympathised with them. But he asked whether the silicon and phosphorus contents were estimated, because he believed the figures would enable one to decide whether the steel was partially melted by cast-iron drops higher up the furnace, followed by the actual melting at the melting zone of steel, having possibly 0.5 per cent. of carbon in the outer skin and 0.2 per cent. on the inside.

Effect of Slag Ledges

MR. A. J. SHORE asked whether the slag ledge had any detrimental effect on the melting, *e.g.*, had the melting rate been computed at intervals throughout the day? He also commented that there was a break in the melting process for half an hour at 12.30, and he asked whether that had any effect on the formation of the slag ledge, and whether the Authors had tried running right through without any break at all. Another question was whether they had tried shutting off one tuyere at a time, each in turn, thus driving the melting zone round.

MR. BEN HIRD, dealing with the question as to whether the quenching caused damage to the linings, recalled that over a period of years in a foundry with which he had been connected it was the practice to quench the cupola linings every night with cold water. Water was applied for about half or three-quarters of an hour through a pipe, and then the men went into the hot steamy cupola with the ganister and fettled it up

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ready for the next day's work. That practice was continued for quite a number of years without really serious damage to the linings.

With regard to the melting of iron and steel, he said that surely an iron bar inserted in a good hot coke fire, even without blast, would melt there if it were left for a time. It was his opinion that in the Authors' experiments the carbon pick-up had lowered the melting point and had resulted in the melting off of the end of the steel bar.

MR. DONALDSON, referring to the use of chunks of ingot mould scrap, asked what weight or surface area of that scrap was melted.

Authors' Reply

MR. N. E. RAMBUSH, replying to the discussion, said the method adopted for quenching the cupola was to direct the water spray towards the centre, thus it did not touch the lining to begin with. At that early stage the water evaporated almost immediately; but as more water was used it would go down a little further, so that there was a gradual quenching. He urged that foundrymen should not be afraid of the process; he had used it years ago on other plants, and there was really nothing in it. When he had first asked Mr. Taylor and his men to quench in that way they did not do it, but had left the cupola to cool without quenching; the result was that the cooling had occupied more than a week. It was true that the quenching gave rise to clouds of steam, and in one of the tests, when the tuyere covers were not properly closed, some steam had come out there. However, in order to prove that there was no difficulty, he would be glad to demonstrate it to any who would care to go to the works to see it.

Future Experiments

The insulating bricks were in the cupola before they had started to run the tests. One cupola lining was now being rebuilt, using a 4-in. thick lining cooled by the blast before it went in through the tuyeres. It would be a basic lining; if that would not do, another would be put in. At a later date it was the intention to run a test with a charge of 100 per cent. steel; then questions with regard to carburising would come much more to the fore.

As to the formation of the slag ledge and the suggestion that high-blast velocities might influence it, he said the quantity of air put through the cupola was maintained constant. Inasmuch as iron had to be made to suit the foundry demand, their cupola had to be shut down now and then during the day's heat. But at times there had been long continuous runs. A slag ledge was formed in nearly all cases, and the longer the period of melting the bigger was the ledge.

Dealing with Mr. Bolton's reference to Fig. 2, and the question as to whether there was any coke in the portion of the well containing the metal and slag, he said the amount of slag at the bottom was very small. But the slag removed from the sides of the cupola contained lumps of coke. There seemed no doubt that the iron drops from the steel bars, which contained 1.2 per cent. or less of carbon, would pick up some from the coke as it passed down.

Test-bar Comments

Whilst he agreed that tests should have been made for phosphorus, silicon, and so on, he pointed out that he and his colleagues were not metallurgical research workers, but were engaged in running a commercial foundry, and had proceeded as practical foundrymen who were endeavouring to apply science. Thus, they had overlooked many things.

The steel test-pieces had been cleaned as well as possible, by rumbling, brushing, and so on. He believed that free carbon would occur in the samples due to the molten cast iron; but they had not proved it. Dealing with a question as to whether he had tried quenching after a run of 4 hrs., he said he had never quenched a cupola earlier than at the end of a day's run, for it would not do if the moulders did not get all the iron they wanted in the shop! In reply to Mr. Turner, he said the quenching did not give rise to any special noise; but there was a great deal of steam.

Dealing with Mr. Driscoll's question as to whether the coke and iron were mixed, Mr. Rambush said that, unless the coke and steel and iron, and so on, were of similar size, he preferred to charge in layers. The CO_2 recorder was found to be useful in the control of the happenings in the cupola. But as there was a constant rate of air blown in, the CO_2 recorder really indicated whether or not the coke bed and cupola were in proper condition. The blast pressure on the cold furnace had not been measured; but as it would seem worth while to do so, it would be done in the next test. Replying to Mr. Harbach's comment as to the discrepancy in the figures representing the dimensions of the cupola, he said this difficulty had arisen because figures were given for the dimensions both before and after lining; the tables were correct.

Replying to Mr. Shore's question with regard to the slag ledge, he said it might be advisable to reduce the rate of flow of air as the cross section narrowed down, but they had not yet proceeded that far with their tests. Until one could avoid the formation of the slag ledge or could limit it to the smallest extent, one could not say that the conditions in the apparatus were constant. If one could not maintain the apparatus in constant shape, how on earth could one expect a constant product? They had tried the closing of tuyeres and had also tried different blast velocities through the tuyeres, and had found very definitely that the blast velocity had a considerable influence on the formation of the slag ledge. They had tried tuyeres which came in at a slant, and they had also increased the velocity three times in order to get the blast right to the centre, but there was still a lot of slag. They had not found that the lining was damaged to an extent that would cause any worry.

Finally, in reply to Mr. Donaldson's question concerning the surface area of ingot mould scrap, Mr. Rambush said they would have dealt with that matter had they realised before making the last test that the condition of all the other metallic charge materials needed as careful control as had been done in the case of the steel test-bars.

Vote of Thanks

MR. J. K. SMITHSON, proposing the hearty thanks of the meeting to the Authors for their Paper, said that in spite of their having disclaimed that there was an element of danger, they were to be congratulated on their courage in embarking on the enterprise they had described.

In dealing with the mechanism of carbon pick-up, Mr. Smithson said he had been content to be guided by analogy, thinking particularly of the old cementation process for making tool steel, where pure iron was packed in carbonaceous material and stewed for a very long time; the time factor there was very considerable, and it was something which one could not imitate in cupola practice. Therefore, he had been led to believe that, whilst there might be a skin effect, the bulk of the carbon pick-up by the steel did occur in the cupola well. He suggested that if they worked out the carbon content of the material as charged and estimated the carbon content of the material at the cupola spout, they would find that, as the percentage of steel increased, so there was an increase in the percentage of carbon absorbed by the steel. He felt that, by dealing with the matter on those lines, they would throw much more light on that aspect of the problem than by pursuing experiments on the lines discussed in the Paper.

As to the danger of putting water into the top of the cupola, he said that the incandescent zone did not extend to any great extent above the tuyeres, and there was a comparatively deep area of material which was only black hot; that had probably saved the situation.

Commending the Paper to study by all concerned with cupola work, he said that it definitely gave a lead on many problems, and undoubtedly would aid further development and would increase our knowledge, which would help in solving many of the remaining mysteries in cupola practice.

MR. F. ARNOLD WILSON seconded.

The vote of thanks was accorded, and Mr. Rambush briefly responded on behalf of himself and Mr. Taylor.

Written Discussion

MR. H. J. YOUNG, M.I.Mech.E., wrote that, in his opinion, this research merited a 10 years' supply of diplomas. It was novel and courageous. The detail involved must have proved both tedious and arduous, particularly for people doing an ordinary day's war work into the bargain. His criticism of such unique research could but aim to contribute to the foundations of these workers' next effort.

He (Mr. Young) noticed that the cupola practice was not that of the ordinary foundry. The bed coke, 54 in. above the top of the tuyeres, was from 12 to 24 in. higher than usual. This might possibly account for unmelted steel occurring in the bed itself, and for ingot mould scrap tending to accumulate 18 in. below the top of the bed. The ratio of 1 of charge-coke to 5.6 of metal was uncommon for a mixture of the ordinary 60 per cent. steel type. How greatly such fuel figures, as regarded both bed and charges, had influenced the results seems to be a question which could be cleared up only by the experiment being repeated, using more normal coke ratio and coke bed height. By the expression "more normal," the writer meant more usually used.

The increased sulphur found in the scrapings did not appear to fit in with the general picture. The Authors said that "the outer surface of the steel absorbs carbon, so it melts, resulting in the formation of a large drop of metal." Hence, there was given a picture of the outer surface of the bar being constantly melted and as constantly washing down to form a drop and, as melting proceeds, further drops, until all was melted. This washing action of that outside metal (which afterwards represented the scrapings analysed by the Authors) would leave behind what might be called a "nascent" surface, ever ripe for the absorption of yet more sulphur. If that were true, one would expect the above-mentioned drop to be highly sulphurous, as the sulphur content of the scrapings revealed in Table V demonstrates. But was that a true picture or was it more probable that the main portion of the surface absorption of sulphur took place between blast-off and the time of the water-quench reaching the bar? It seemed also not inconceivable that the phenomenon of the presence of free carbon might be due to the blast-off period, followed by the water-quench, whilst the bars were presumably exceedingly hot. Thirty years ago Mr. Colin Gresty and the writer did a number of experiments with a model cupola, one series consisting of having steel bars running vertically through the charges and the coke bed, and their withdrawal at various intervals of time after blast-on. While there was found to be much the same absorption of carbon as shown here, no free carbon was detected, even though the analytical and microscopical portions of the research were conducted with every care.

The Authors stated that the rate of complete melting of the different metallic constituents was mainly governed by their shape and weight, as well as their relative melting temperatures, and, secondly, that those taking a longer time to melt than others might not be melted completely until they had descended into the coke bed to some considerable depth. These were two very important statements, and he (Mr. Young) could not yet see that the Paper fully justified them. Perhaps the Authors would think it worth while to do some experiments with steel specimens of several shapes and weights mixed up with cast-iron specimens of similar shapes and weights.

Finally, he could pay the Authors no greater compliment than by expressing his sincere hope that they present several more Papers on the same subject and along the same lines.

In reply to Mr. H. J. Young's written contribution, MR. RAMBUSH mentioned that some of the points had been raised and dealt with in the verbal discussion, but (1) the reason for the high coke consumption was that at periods of the day's heat up to 60 per cent. steel charges were to be melted in the same cupola, and (2) as to the sulphur content found in the steel pieces, possibly this would have been affected by the subsequent influence of water-gas invariably generated at some time of the water-quenching period.

NEW CATALOGUES

Special Alloy and Tool Steels. William Jessop & Sons, Limited, and J. J. Saville & Company, Limited, of Brightside Works, Sheffield, 1, have just issued a particularly comprehensive catalogue running to over 100 pages. It gives the composition of about 150 different grades of steel, yet this by no means exhausts the list of alloy steels made in Sheffield. It appears to the reviewer that whilst the list is constantly being extended, the old original steels are still retained. For instance, for magnet steels the 6 per cent. tungsten is still listed alongside the modern Alnico series. All the tool steels used by the foundry industry—chisels, wood working, hammers—are all listed in their latest concepts. The catalogue should contain a list of the directors and perhaps the leading executives, as this gives the possibility of a personal relationship between the buyers and users and the firms. Moreover, in future editions some pictures of the works could usefully be included. Beyond these suggestions, the reviewer congratulates all those whose efforts have gone to produce such an excellent piece of publicity.

Foundry Equipment and Supplies. The Midland Monolithic Furnace Lining Company, Limited, Black Seam House, Narborough, Leicester, have recently issued an attractive catalogue covering a wide range of products. The initial material dealt with is the Black Seam refractory clay, and a photograph is included of the quarry. This clay is available in several grades. Next, a wide and efficient range of pre-heated, down draught crucibles are described and illustrated, and commendably there is given a code number for the ordering up of spare parts. The notes on the care of crucibles are essentially sound and worthy of close study by those whose duty includes the supervision of the melting plant. The last few pages are devoted to the illustration and listing of a wide range of foundry tools. They are very attractively set out, and register a distinct advance in the presentation of such matters, and the compiler of the catalogue is to be congratulated.

High-duty Irons. Carrying the caption "The Specification of Meehanite Metal," a booklet received from the International Meehanite Metal Company, Limited, of 66, Victoria Street, London, S.W.1, brings to the notice of the engineering trades the properties of a very wide range of high-duty irons marketed by their licensees. Listed under four main types—general engineering castings, heat resisting, wear resisting, and corrosion resisting, with 22 sub-divisions, the booklet details by tabular matter and graphs data of the kind asked for by the modern engineer. Additionally, information is presented on heat-treatment; stress relieving; welding; surface hardening, and tool design and machining. Finally, the objectives of the Meehanite Research Institute are set out.

MR. G. R. WEBSTER, vice-president of the London branch of the Institute of British Foundrymen, opened the part-time day classes for foundry apprentices at the Borough Polytechnic last Thursday.

MALLEABLE IRONFOUNDERS' CHAIRMAN FOR 30 YEARS

MR. A. E. HURST'S SERVICES RECOGNISED

High tributes to Mr. A. E. Hurst's work as chairman of the Malleable Ironfounders' Association, a position from which he has just retired, after 30 years' unbroken service, were paid at a recent dinner at Walsall, when he was presented by Miss L. Verity (secretary), on behalf of the members, with a cheque for £194 5s. Miss Verity referred to Mr. Hurst as the guide, philosopher and friend of the malleable iron trade. He had always striven to give equal service to every member of the association. Surely that was the acid test of a chairman who was himself in the iron trade, she said. Miss Verity could not recall a single instance when the association had been in trouble with any trade union leader, and that was the spirit which must be fostered more than ever to-day.

Mr. Hurst, in thanking the members for their splendid gift, said he thought it was a matter for congratulation to the members of the association that there had never been a strike in Walsall in the industry since the last war. He had always been anxious to promote good feeling between the workers and employers and to be fair to both sides. In the future he would like to feel that the young people of the town would realise that it was an industry worth going into. He pointed out that, if young people were to come into the industry, it was up to the employer to make it attractive and worth while.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. *each.*

571,012 WALLWORK GEARS, LIMITED, and HUNTER, J. Bottom boards or platens for use in the production of sand moulds.

571,071 WINDSOR, R. H., and GASPAR, E. Injection-moulding machines.

571,096 MULLARD RADIO VALVE COMPANY, LIMITED, and HAYES, C. F. M. Electric resistance furnaces.

571,103 BOUND BROOK BEARINGS (G.B.), LIMITED, and HATHAWAY, H. W. J. Anti-friction bearings.

571,115 DU PONT DE NEMOURS & COMPANY, E. I., and GRAY, A. G. Electrodeposition of zinc.

571,122 BRITISH THOMSON-HOUSTON COMPANY, LIMITED (General Electric Company). Method of brazing metals.

571,128 GENERAL MOTORS CORPORATION. Impregnation of porous metal parts.

571,139 GENERAL MOTORS CORPORATION. Method of and apparatus for making porous metal articles.

571,142 UNITED STEEL COMPANIES, LIMITED, RUSSELL, G. A. V., and COY, E. R. Repairing of the hearths of metallurgical furnaces.

571,172 HUNTING, P. L., BOWRING, F. C., and BOOT, R. H. F. Electrode holders for arc welding.

BOOK REVIEWS

"Principles of Industrial Process Control." By D. P. Eckman. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, 37, Essex Street, London, W.C.2. Price in U.S.A., $3.50.

Modern trends in industrial process control have as yet made little impression on the foundry industry, and in the nature of things cannot be expected to have the same influence as on purely mechanical processes. Yet the foundry has a lot to gain by a study of process control, since it is along these lines that future development will lie. This applies both to production quantity control and to control of product quality. For these reasons this book is welcomed, as a contribution to the study of the principles of process control. The aims of process control are given as uniformity of product, reduction of production costs and improvement in quality. These aims apply as much to the foundry as to any other industry. The principles on which process control is based, with particular reference to automatic control, are discussed in some detail and are applicable to all processes.

A good deal of the book is devoted to the theory and mechanics of automatic control, much of which has only limited application to the foundry. The foundry engineer, however, will find the information extremely useful in suggesting the lines along which further developments can be made in automatic control of foundry variables, particularly in metallurgical control.

In discussing the quality of automatic control the author states: "The results of automatic control must always be evaluated in terms of quality of the finished product rather than in terms of accuracy or deviation of the controlled variable." This is sound and is the basis of the modern method of estimating the standard of control. The value of the book would have been greatly enhanced had the author gone a step further and given examples relating automatic control methods to the quality of the product and discussed methods for measuring product quality.

Although not of particular reference to the foundry, the book will be of value to the foundry engineer and to all interested in control problems.

E. W. HARDING.

"The Manufacture and Production of Aluminium-alloy Forgings and Stampings." By J. R. Handforth and J. Towns Robinson. Published for the Wrought Light Alloys Association by the Aluminium Development Association, Union Chambers, 63, Temple Street, Birmingham, 2. (Price 1s.)

To those practised in working with steel and copper-base alloys, the forging of aluminium alloys is likely to present some difficulty. The aluminium alloys have lower melting points and their hot working range is below "red heat," so that the technique demanded in the production of forgings is to those accustomed to the older arts, a new one. At the present time very heavy tonnages of aluminium alloys are being produced without difficulty, in hundreds of forges throughout the world, and this brochure, prepared and published by the Technical Committee of the Wrought Light Alloys Association will, whilst supplying useful information to those familiar with light alloy forgings, be found to be invaluable by forgers approaching the problems of forging aluminium alloys for the first time, since it presents concisely but in detail all the facts relevant to the manufacture of good quality light alloy forgings.

In this country forgings are made primarily from extruded bar or cast blanks. These have markedly different characteristics, which involve different techniques of handling during forging, and the Authors rightly deal in detail with the production of forging stock by both methods. The preparation of blanks for forging is then discussed both in terms of the machining requirements and preheating for forging; under the latter heading, the types of furnace most suitable for the purpose are described. The importance of accurate furnace control is emphasised, as is the importance of the time-factor in the heating of the stock to forging temperature. A rough method of ensuring that the stock is held long enough in the furnace is to maintain the blanks of the set period for approximately one hour per inch of their thickness.

The plant required for the manufacture of forgings is next considered, the essentials of the modern forge—drop hammers, friction presses, pneumatic hammers, clipping tools, swaging or fuller tools and die blocks—being discussed. The supreme importance of die design is stressed, and a complete layout of the whole process of the manufacture of a forging is recommended. This should include all operations from the machining of the die to the final stamping of the dummies; while such features as size, shape, direction of grain flow, shrinkage, and the position of the die in the drop hammer, must all be predetermined. The two main categories of die steels, the plain carbon steels and the alloy steels, are then discussed. The great range in size and complexity of forged parts means that fabrication details can be discussed in this brochure only in a general manner. Nevertheless, the fundamentals are outlined at some length. Heat-treatment is also discussed; and the Paper concludes with chapters on the inspection and testing of forgings. The book is well illustrated with photographs, line drawings and graphs. Much information is presented in tabular form.

U.S. BLAST-FURNACE RECORD

Another world's blast-furnace record is claimed to have been made in July by the No. 2 blast furnace at the Edgar Thomson Works of Carnegie-Illinois Steel Corporation, with a production for the month of 50,590 tons. The previous monthly record was held by Great Lakes Steel Corp., one of their furnaces having produced 49,705 tons in 1943. The new record is reported to have been more unusual because it was made without scrap being included in the charge. The best weekly record was for the week ending July 26, when 12,189 tons of pig-iron were produced, and the best daily record was made on July 12, when the output totalled 1,976 tons, or 48 per cent. over the 1,330-ton rated capacity of the furnace.

BRITISH IMPORTS OF IRON & STEEL

PURCHASES DURING THE WAR YEARS

The following table, extracted from Board of Trade returns recently published, shows the value of British imports of iron and steel and manufactures thereof during the war years. Values of 1938 imports also are given. The tonnage of imports was shown in a table published in our issue dated November 8.

	1938.	1939.	1940.	1941.	1942.	1943.	1944.
	£	£	£	£	£	£	£
Pig-iron	2,213,670	1,993,129	5,216,946	9,188,137	3,231,711	3,539,753	2,704,431
Ferro-alloys, etc.—							
Ferro-chromium	393,034	570,984	1,077,498	1,686,916	1,315,983	2,396,480	1,117,591
Spiegeleisen and ferro-manganese	89,370	132,415	195,008	127,596	179,491	300,726	6,216
Ferro-silicon and silicon and alloys thereof	346,406	557,385	1,474,731	1,521,657	1,180,468	2,389,415	1,273,940
All other descriptions	192,987	285,822	464,280	715,752	934,969	953,155	563,459
Ingots, other than of special steel	170,838	252,964	4,792,901	6,449,637	5,998,923	6,902,411	3,848,968
Blooms, billets and slabs, other than special steel	2,344,568	2,546,000	14,879,511	20,514,279	13,406,834	12,965,708	10,282,217
Iron bars	152,246	140,363	63,536	118,195	28	21	4
Sheet bars	243,064	2,870,330	2,927,214	2,677,931	388,194	378,979	20,521
Wire rods	662,685	677,512	2,056,579	1,872,736	1,994,016	2,295,001	1,517,413
Other steel bars and rods	1,166,540	976,221	1,698,275	3,949,807	2,504,010	1,910,242	935,488
Ingots, blooms, billets, slabs, bars and rods of special steel	305,759	242,532	2,549,727	9,578,119	8,955,410	8,697,773	1,026,556
Angles, shapes and sections	485,157	396,649	1,491,251	1,352,672	15,380	156,820	11,419
Castings and forgings in the rough or machined	136,564	83,935	86,270	27,206	3,504	4,176	—
Girders, beams, joists and pillars	560,872	412,596	918,666	282,875	508	152,007	—
Hoop and strip	762,645	855,411	560,875	932,912	241,890	1,642,791	1,508,805
Plates and sheets—							
Not galvanised, not tinned, etc.	1,287,835	1,862,811	2,916,179	2,973,995	442,595	6,488,500	2,484,409
Coated	24,093	611,878	237,999	33,754	8,628	108,818	12,700
Tubes, pipes and fittings—							
Cast, including fittings	33,481	32,519	350,351	94,868	46,824	36,993	65,357
Wrought tubes and pipes	578,922	679,537	687,194	2,296,070	2,850,484	4,283,639	2,285,907
Fittings for wrought tubes, etc.	175,119	196,825	62,204	43,356	31,166	606,639	73,658
Railway, etc., material	137,764	91,725	1,365,128	277,014	1,249,914	254,345	343,351
Wire (except insulated wire)	241,112	357,316	583,620	408,048	799,289	812,182	1,200,704
Wire nails, tacks and staples	290,386	248,915	143,279	63,677	48,575	19,818	5,311
Other wire manufactures	125,866	97,649	40,160	368,557	15,293	26,823	110,591
Nails, tacks and staples (other than wire nails, wire staples and insulated staples), rivets, washers, wood screws, etc.	207,164	206,229	136,142	30,999	35,960	65,660	3,808
Bolts, nuts and metal screws	252,785	260,671	445,675	358,545	406,890	485,035	193,552
Stoves, grates and ranges	70,747	62,640	25,657	19,612	11,415	22,002	16,936
Baths	190,106	126,121	381	—	3	—	5
Hollow-ware	234,653	150,869	72,028	2,150	1,354	389,717	337,737
Other manufactures of iron and steel	739,608	639,376	673,191	1,129,160	745,300	690,230	981,564
Total	14,816,046	18,619,329	48,192,456	69,096,232	47,045,009	58,975,859	32,932,618

"FOUNDRY PRACTICE" (No. 77), the house organ of Foundry Services, Limited, Long Acre, Nechells, Birmingham, 7, contains useful articles on the casting of angular and curved core grids and on cast-on test bars.

A NEW SPANISH METALLURGICAL ASSOCIATION

A new metallurgical society—Asociación Técneca Española de Estudios Metalúrgicos (Spanish Technical Association for Metallurgical Study)—held its first congress at Barcelona during the summer. Foundry technology was included and a Paper on "Notes on the Testing of Cast Iron," by Mr. A. M. Modolell, was presented to the congress.

The official organ of the association, "Técnica Metalúrgica," is at present published a little irregularly, but it should eventually appear monthly. There are no German advertisements in it! The medal of the association was awarded to Mr. J. R. Barnola, a prominent Barcelona industrialist.

STEEL WIRE PRICE CHANGES

INCREASES AUTHORISED

The Minister of Supply has made the Control of Iron and Steel (No. 43) Order, 1945, which came into force on November 12. The Order increases the price of certain kinds of wire and wire products.

Hard drawn mild steel wire and uncoated hard drawn mild steel wire in straight lengths remain unchanged in price, but there are increases on other types of wire, with consequential alterations in the prices of wire netting, barbed wire and certain types of wire rope. Wire nails are not affected.

The following notes indicate the related Schedules affected and outline the alterations involved.

Mild Steel Wire and Certain Wire Products

Old Schedule No. 211; new Schedule 228.

Prices varied as follows:—Hard drawn bright in coils—no change. Uncoated wire in straight lengths—no change, except hexagons, increase 15s. per ton. Mild drawn bright—basis increase 45s. per ton. Annealed wire—basis increase of 15s. per ton.

Galvanised wire—basis increase of 35s. per ton. Coppered wire—basis increase of 45s. Tinned wire—basis increase of 45s.

Barbed wire—increase of 2d. per 100 ft. coil, 10d. per 110 yd. reel, 1s. 3d. per 220 yd. reel.

Florist's Wire

Old Schedule No. 212; new Schedule 229.

Bright or annealed, 3d. per 12 lbs. 17/22 g. Bright or annealed, 6d. per 12 lbs. 23/32 g. Tinned or galvanised, 4½d. per 12 lb. 18/22 g. Tinned or galvanised, 6d. per 12 lbs. 24/32 g.

Stitching Wire

Old Schedule 213; new 230.—Wound on spools, 7s. per cwt. Catchweight coil, 9s. per cwt.

Wire Netting

Old Schedule 214; new 231.—2½ per cent. increase.

Chain Link Fencing

Old Schedule 77; new 232.—Approximately 4½ per cent. increase.

Wire Ropes

Old Schedule 225; new 233.—No change except galvanised mild steel ropes all sizes 2s. 9d. per cwt. increase. Seizing wire (strand), up to 22 g., 2s. 9d. cwt.; over 22 g., 4s. cwt. increase.

The remaining Related Schedules to the Control of Iron and Steel (Nos. 32, 34, 35, 37, 40 and 43) Orders, 1943-45, remain unchanged and all the schedules may be inspected at the offices of the Iron and Steel Control, Steel House, Tothill Street, London, S.W.1.

The following prices now ruling incorporate the alterations set out above:—

Mild Steel Wire, catchweight coils, 6/8 standard wire gauge, for sales by makers in 2-ton lots.—Hard drawn, £23; mild drawn, £26 15s.; annealed, £25 5s.

Galvanised Barbed Wire.—2 or 4 point, 2-ply, 12½ gauge, for sales by makers in 2-ton lots, £34 5s.

Wire Rope.—Best patent steel 80/90 tons per sq. in., basic grade 1 in. dia., 6 strands each of 7 wires with main fibre core, for sales by makers, £48 5s.

Wire Netting.—Galvanised after made, 2-ply selvedges, 3 in. mesh, 10 gauge, 36 in. wide, per roll of 50 yards, 12s., plus 2½ per cent.

Wire Chain Link Fencing.—2 in. mesh, 14 gauge, 3 ft. high, per roll of 25 yards, £1 5s., plus 2½ per cent.

Wire Nails.—Ordinary round chequered head, 6 in. by 4 gauge—delivered in 2-ton lots in England and Wales (except Isle of Wight, Cornwall and Devon), £25 15s., plus 3½ per cent.

Wire Rod Reinforcement Mesh and Wire Reinforcement Mesh.—Working stress 25,000 lb. per sq. in., weight 4.32 lb. per sq. yd., for sales by makers, 1s. 2¼d. per sq. yd.

MASS PRODUCTION OF HOUSING FITTINGS

Mr. A. A. Saunders, recently appointed Director of Housing Supplies in the Ministry of Supply, outlined last week a plan for the supply of engineering fittings and components for prefabricated houses and also for the houses in the building programmes of local authorities. This, he indicated, was to be a mass-production undertaking controlled by the Ministry of Supply. The manufacture would be so closely controlled in the early stages and till the volume of supplies overtook the acutest need that it would virtually be a Government monopoly.

Mr. J. Wilmot, the Minister of Supply, said that 19 or 20 Royal Ordnance factories would be turned over to the manufacture of house fittings. For the provision of building materials for houses of the traditional type the responsibility rested with the Ministry of Works, but the Ministry of Supply had great expectations of the development of an entirely new type of two-storey pressed steel house.

DEVELOPMENTS AT HORSELEY WORKS

Horseley Bridge & Thomas Piggott, Limited, Tipton, Staffs, expect to complete their works reconstruction scheme by next July. A start was made by the reconstruction of the machine shops and the installation of new plant, which was followed by the erection of an entirely new building to house the light constructional steelwork department, to take the place of the building destroyed by fire two years ago. Other buildings are in progress which will contain the bridgework and tank-making departments, together with an entirely new layout of ancillary plant. At a later date the company are transferring the foundry to a more suitable site in the works, and installing new plant and equipment. During the next three years further reconstruction plans will be embarked upon.

UNITED STEEL COMPANIES' PLANS

A substantial programme of expansion and development has been prepared by the United Steel Companies, Limited, to overtake the time lost during six years of war and to help to meet the increased demand for iron and steel products which it is expected will be made upon this country. This statement is made by the chairman, Sir Walter Benton Jones, in a brief review accompanying the accounts for the year to June 30. He adds a warning, however, that the rate of progress depends more than anything else upon an adequate supply of labour, and that in this respect much depends upon the priority which the authorities may decide to allocate to the industry.

NEWS IN BRIEF

MR. JOHN BOSTOCK, late metal merchant, of Hazel Holme, Cleator, Cumberland, is paying a first and final dividend of 3s. in the £ at 14, Lowther Street, Carlisle.

HEAP & DIGBY, LIMITED, engineers, are being wound up voluntarily. Mr. William E. Hanson, 25-26, Tudor Chambers, Station Road, London, N.22, is the liquidator.

THE MINISTER OF SUPPLY has agreed to the release of Mr. H. N. Butler from his appointment as Director of Supplies (Special). The continuing functions of the Directorate have been transferred to the Directorate of General Stores.

WHEN FIRE BROKE OUT recently at the Sneddon Foundry of Henry & Galt, of 16, New Sneddon Street, Paisley, damage amounting to several thousand pounds was caused. The engine shop and patternshop were seriously damaged, but firemen succeeded in saving an adjoining building.

MAJOR PETER GEOFFREY ROBERTS has recently joined the board of the Wellman Smith Owen Engineering Corporation, Limited. Major Roberts, who is M.P. for the Eccleshall Division of Sheffield, is the son of Sir Samuel Roberts, Bt., chairman of the Wellman Corporation. He is a barrister.

THE SCOTTISH STAMPING & ENGINEERING COMPANY, LIMITED, proposes to increase its capital to £250,000 by the creation of 1,000,000 additional 2s. ordinary shares. Subject to approval by the shareholders, the directors propose to offer 703,320 of the new ordinary shares to holders at 3s. 6d. per share, in the proportion of one for every share held.

NEGOTIATIONS are now at an advanced stage for the acquisition by the Board of Trade of a 40-acre site at Blantyre, for another industrial estate in Lanarkshire. Use of the land is subject to Lanark County Council's approval, but it is not expected that there will be any difficulty in that respect. The estate will have 240,000 sq. ft. of floor space, and will provide employment for 2,000 people.

RECENT CHANGES in organisation at the British Thomson-Houston Company, Limited, include the following. In addition to appointments already held, Mr. H. Jack becomes chief electrical engineer; Mr. A. A. Pollock, chief mechanical engineer; Mr. G. S. C. Lucas, assistant chief electrical engineer; and Mr. K. R. Hopkirk, assistant chief mechanical engineer. These arrangements do not affect the Turbine Engineering Department, of which Mr. R. H. Collingham remains chief engineer.

THE DIRECTORS OF Dorman, Long & Company, Limited, regret that it will not be possible for their report and the statement of accounts for the year to September 30, 1945, to be completed and ready for presentation before the end of the calendar year, as certain important matters must first be settled with Government departments. A formal meeting will be held on November 29, when the chairman will move for an adjournment until a date when it will be found possible for the accounts to be submitted.

A PEACETIME PROGRAMME for the production of Diesel locomotives for industry and tractors for the farm was put into operation last week by John Fowler & Company (Leeds), Limited. For six years the firm has been engaged to maximum capacity on war work, and the change-over is made with the knowledge that orders already in hand and pending, both from the home and export markets, will ensure full work for a long time. The war programme finished on Saturday, November 10, when the last tank came off the line.

STEWARTS AND LLOYDS OF SOUTH AFRICA, LIMITED, propose to raise the capital to £1,370,000 by the creation of 410,000 £1 ordinary shares and to distribute them to holders in the form of a 100 per cent. bonus. Out of undivided profits, £410,000 is to be applied in paying up these new shares, which will rank *pari passu* with the existing ordinary shares. These shares will then be distributed credited as fully-paid to ordinary holders in the proportion of one new share for every share held. An extraordinary meeting is convened for November 30 to consider the proposal.

AMONG NEW FACTORIES to be set up in the Lanarkshire industrial area are the following:—At Newhouse: Vactric, Limited, makers of domestic electrical appliances, who have taken over 800,000 sq. ft.; Electro Platers, Limited, Glasgow, 130,000 sq. ft.; W. & R. Swan & Company, Limited, safety razor manufacturers, Sheffield, 50,000 sq. ft.; Robertson Bakery Engineering Company, Limited, Glasgow, 15,000 sq. ft.; Unicone Company, Limited, tube manufacturers, Baillieston and Shettleston, 15,000 sq. ft.; and Range Boilers, Limited, 25,000 sq. ft. At Chapelhall: Jonas Woodhead & Sons, Limited, spring manufacturers, Leeds, 30,000 sq. ft.

IN AN INTERVIEW with our Scottish representative, Col. W. C. Devereux, chairman of Renfrew Foundries, Limited, said that he anticipates that between 3,000 and 4,000 people will be employed at the Hillington foundry. "The Hillington light alloy foundries are probably the largest and best equipped in Europe for the mass production of light alloy castings," he added. He believes that these materials have a very important part to play in all British industries and the foundries constitute valuable capital assets which the country cannot afford not to utilise fully. At Hillington a wide variety of sand and die castings for domestic and industrial equipment will be made. "I have just completed arrangements for them to make the castings for a revolutionary new, but fully proven, motor-car, the main components of which consist chiefly of light alloy castings," Col. Devereux said. "We are also going ahead with numerous projected civilian uses of light alloy sand die castings. These include chairs and other domestic furniture, saucepans, electric cooker parts, flat irons, and numerous other articles which will be needed in very large quantities." Apart from these activities the foundries will continue to play an important part in the production of castings for the automobile and aircraft industries.

THE MODERN PIG

IF YOU WANT...
clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify
STANTON MACHINE CAST PIG IRON

SPECIFICATION

WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
Thickness	3¼ inches

(at notch 2½ inches).

Made in our well-known

STANTON, HOLWELL & RIXONS BRANDS

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

COMPANY RESULTS

(Figures for previous year in brackets.)

South Durham Steel & Iron—Interim dividend of 6% (same).

Arundel Coulthard—Profit, £6,230 (£12,430); dividend of 2½% (4%); forward, £23,819 (£21,964).

Matthew Hall—Profit for 1944, after tax and depreciation, £12,615 (£4,618); dividend of 10% (nil).

Atlas Steel Foundry & Engineering—Final dividend of 17½% and a bonus of 10%, making 42½% (same).

National Canning—Net profit for the year ended May 31, £40,743 (£44,046); ordinary dividend of 10% (same).

Bentley Engineering Company—Profit for 1944, £138,992; E.P.T. and income-tax, £120,660; dividend of 20%, free of tax; forward, £17,675 (£15,974).

Murex—Net profit for the year ended June 30, £213,032 (£239,446); dividend of 17½% and a cash bonus of 2½% (same); forward, £126,680 (£125,398).

British Piston Ring—Net profit for the year ended July 31, £43,862, including recovery of E.P.T. of £58,000, and making full provision for tax up to and including 1946-47.

Yarrow & Company—Profit, after depreciation, for the year to June 30, £49,634 (£61,091); dividend of 10%, plus bonus of 5%, both free of tax (same); forward, £71,112 (£43,988).

Thomas Blackburn & Sons—Trading profit for the year ended June 30, £75,110 (£41,800); net profit, after providing for taxation, depreciation, etc., £12,130 (£12,623); dividend of 9% (8%); to general reserve, £4,000; forward, £3,520 (£3,040).

Frederick Braby & Company—Trading profit for the year ended September 30, £188,244 (£295,737); taxation, £105,000; depreciation, £27,579; net profit, £53,692 (£53,691); to suspense reserve account, £25,000; dividend of 10% (same); forward, £65,167 (£66,700).

Samuel Osborn & Company—Profit for the year ended July 31, including investment income and after depreciation, income-tax and E.P.T., £55,811 (£55,163); preference dividend, £7,183 (same); contingencies reserve, £25,000 (same); ordinary dividend of 15% £22,068 (same); forward, £131,077 (£129,517).

Arthur Lee & Sons—Net profit for the year to July 31, after charging depreciation, deferred repairs provision, war damage insurance, directors' fees, etc., £108,697 (£105,717); to general reserve, £50,000 (nil); plant obsolescence, nil (£45,000); final dividend on the ordinary shares of 25%, making 40%; forward, £48,828 (£49,438).

Sheffield Forge & Rolling Mills—Profit for the year ended June 30, after charging depreciation and including grants from the Prices Fund of British Iron & Steel Corporation, Limited, £11,460 (£27,885); dividends and interest, £1,451 (£1,356); taxation, £5,959 (£15,102); to general reserve, nil (£5,000); dividend of 5%, less tax, £2,044 (18¼%, £7,665); forward, £11,526 (£7,520).

Thompson Bros. (Bilston)—Profit for the year to July 31, 1945, after E.P.T., £58,562 (£57,892); net profit, after depreciation, A.R.P., war damage insurance, and income-tax, £21,979 (£20,186); surplus on maturity of director's life policy, £2,212; final ordinary dividend of 7½%, plus bonus of 7½%, making 22½% (same); to general reserve, £10,000 (same); forward, £16,357 (£15,110).

Wm. Neill & Son (St. Helens)—Trading profit for the year ended March 31 last, £62,991 (£70,896); depreciation provided on plant sold now written back, £1,682 (£855); repayment of contributions to trade export fund, £9,870 (nil); depreciation, £3,339 (£4,036); loss on sale of plant, etc., £4,004 (£158); taxation, £47,000 (£52,000); deferred repairs, £13,000 (£7,000); dividend of 15⅛% (20⅝%); forward, £8,589 (£8,352).

Electric Furnace Company—Loss for the year ended March 31, £1,771 (profit £79,262); brought in, £9,733; dividend from subsidiary company, £4,000; estimated E.P.T. recoverable, less provision for income-tax, 1945-6, £25,000; interim dividend of 3½% on the ordinary shares, £2,739; final dividend of 4½% (£3,521); dividend of 8% on the cumulative preferred ordinary shares, £6,840; to general reserve, £10,000; forward, subject to directors' remuneration, £10,312.

IN PARLIAMENT

Surplus Metal

MR. KING asked the Minister of Supply and of Aircraft Production for a statement of policy regarding the disposal of surplus quantities of brass, copper and other metal.

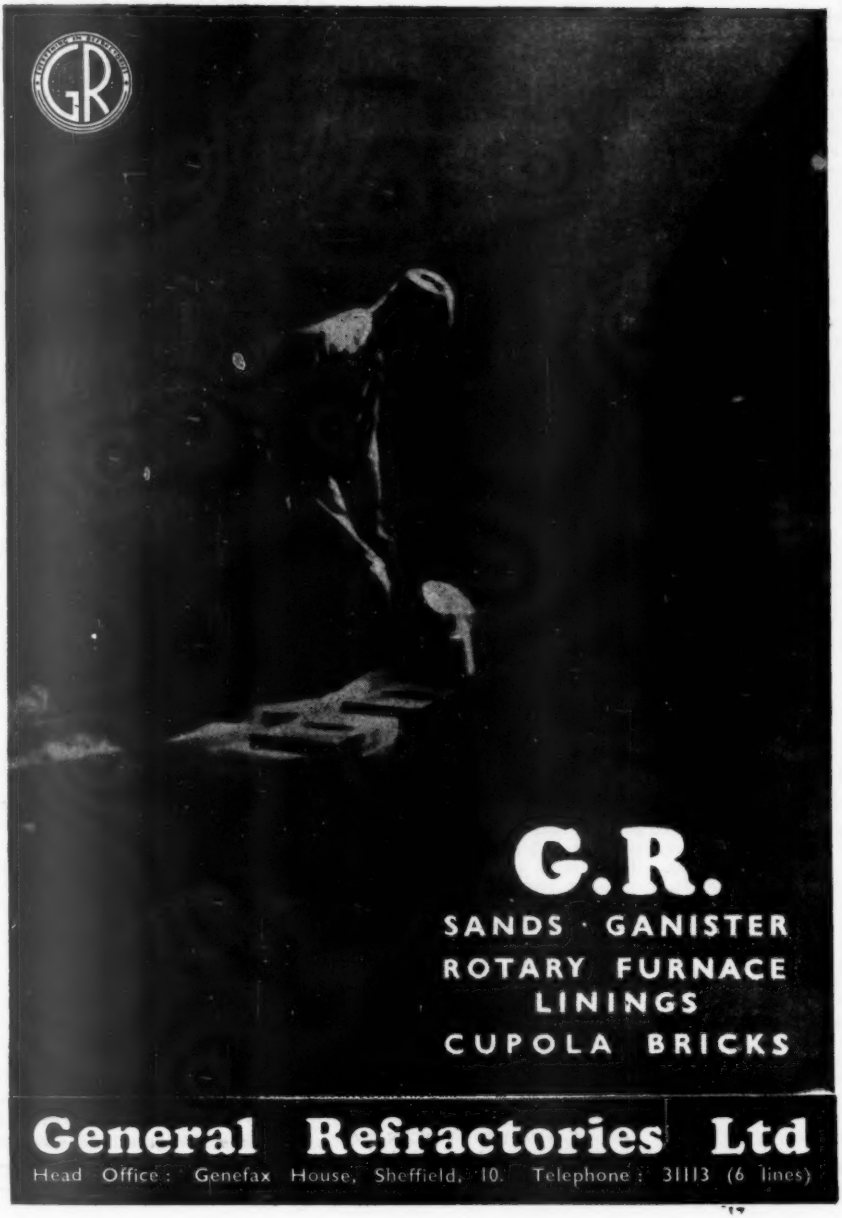
MR. LEONARD (Parliamentary Secretary) said that considerable tonnages of non-ferrous metals in various forms were becoming available for disposal, principally from the termination of war contracts and from the breaking down of munitions. In those cases where this material was saleable in manufactured or semi-manufactured form, it was disposed of in those forms: in other cases it was remelted in Government depots or disposed of as scrap. During the first nine months of this year some 51,000 tons of non-ferrous metals had been sold as scrap. Government factories normally drew their supplies of semi-manufactured material and scrap from the stocks available to the Government.

OBITUARY

MR. JAMES HEPBURN died suddenly at Kirkcaldy on November 9. He was a director of the Fife Forge Company, Limited.

MR. CECIL HENRY WILSON, M.P. for Attercliffe for 18 years, died in London on November 7, aged 83. He was an honorary Freeman of Sheffield, and managing director of the Sheffield Smelting Company, Limited.

MR. H. B. REYNOLDS, who for about 30 years was plant manager with Babcock & Wilcox, Limited, Renfrew, died on November 12. Mr. Reynolds joined the firm as a young man and retired about 12 years ago. He was awarded the O.B.E. in recognition of his services during the last war.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Raw Material Markets

IRON AND STEEL

In addition to ample supplies of native ironstone, bigger tonnages of Scandinavian and North African ores are now reaching the blast furnaces. Deliveries of coke, too, are ample for current needs, and if, as is expected, there is a further expansion in the demand for pig-iron for the light foundries, additional blast furnaces could be lighted up at comparatively short notice. Meanwhile, production of light castings will remain limited until more man-power is recruited. At the engineering foundries there has only been a partial transition from war to peace contracts, and no difficulty is experienced in obtaining full supplies of refined and low- and medium-phosphorus irons.

Supplies of cast-iron and steel scrap are fairly easy, as is the case also with ferro-alloys, particularly ferro-manganese and ferro-silicon. All foundries want limestone, ganister and firebricks, and here, again, the supply position is satisfactory. There is no change in the foundry coke position. Good supplies are passing through regularly and this has been the case for several months.

A fair amount of business is being placed for bar iron. The demand for No. 3 and No. 4 bars continues to be very steady and most makers have sufficient work for the next two months. Best bars are being ordered in larger quantities from certain of the heavy trades, good support being forthcoming from the wagon and chain makers and more recently from the shipyards. Some makers of bar iron have more than sufficient orders for small sizes and light gauges.

Though British steelmakers are striving to meet the heavy calls for semi-finished steel, there is a definite shortage. It is understood that the Control has made further purchases overseas, so that the balance between supply and demand will ultimately be restored. But in the meantime the position is becoming increasingly difficult and, although all sorts of defective material are being used for re-rolling, the mills are running on very slender reserves.

The rise in the export price of light sheets has not had much effect because producers are not permitted to exceed their fixed quotas. There is an enormous overseas demand for sheets, but home requirements, too, are heavy and urgent. Thus the output of the mills is sold for many months ahead. There has also been a substantial accession of orders for light sections, small bars, etc., while the plate mills have a bigger volume of work in hand than at any previous period this year.

NON-FERROUS METALS

The Directorate of Non-Ferrous Metals has decided that sales of best select copper will no longer be made by the Control for home consumption, and that purchases shall be made direct from producers in this country. The reason for this step is attributed to the fact that some consumers were supplied from controlled stocks, and producers then had a shortage of orders, with the prospect of reducing output.

Statistics issued by the American Copper Institute for October, show that production of crude copper was 69,851 short tons, as against 64,366 tons in September. Refined output was 70,361 tons, compared with 45,145 for the previous month, while stocks of refined copper at the end of the month stood at 73,803 tons, an increase of 5,012 tons.

No further news is forthcoming of the tin situation in Malaya. Consequently, any prospective plans for the tin-mining industry are held up. It is now some weeks since the committee, set up by the Malayan Chamber of Mines, was despatched, and only one report has been received.

The nickel output of Canada for July of this year was 11,947 short tons, thus making a total of 79,847 tons for the first seven months of 1945, a decrease of some 1,245 tons on the previous year.

EFFICIENCY OF BRITISH INDUSTRIES

References to the inefficiency of British industry which one saw in the lay Press from time to time were not only erroneous, but were detrimental to the future of our export trade, said Sir George H. Nelson, chairman and managing director of the English Electric Company, Limited, when opening the company's "War Activities" Exhibition at Queen's House, Kingsway, London, W.C.2. Such references would scarcely encourage overseas buyers to place their orders in Britain, and our return to prosperity depended largely on fostering export connections. There were, of course, certain inefficiencies to be found in British industry, as there were in all branches of life, but the country would not be where it was to-day if its industries were inefficient.

Inadequate space prevents the full scale of the company's immense war effort being outlined, but the exhibition does serve to give an indication of the part played by the English Electric Company in wartime, while peacetime products are also illustrated in a display of 50 of the most important groups. The exhibition was opened to the general public on Monday last.

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